



A Northwest utility funded lighting education facility promoting commercial and industrial energy conservation.

Lighting Design Lab

DOE SSL Market Introduction Workshop

Portland, OR

Presented by
Kurt Nielsen, LC, CLEP





What is the Lighting Design Lab

- ⊕ **Regional Lighting Education and Demonstration Center**
for the advancement, training, promotion, & support of quality energy-efficient lighting technologies and practices.
- ⊕ Supported by regional utilities and energy-efficiency partners
- ⊕ Serving the non-residential segment throughout the Pacific NW



Lighting Design Lab Services

- ⊕ Classes (local & regional)
- ⊕ Demonstration Area
- ⊕ LDL LED Qualified Products List
- ⊕ Lighting Consultations
- ⊕ Website Resources
- ⊕ Outdoor Lighting Center
- ⊕ Product Evaluations
- ⊕ Technical Information
- ⊕ Mock-Up Facility
- ⊕ Lighting Library
- ⊕ Tours of Facility
- ⊕ Newsletter
- ⊕ Lighting Guides
- ⊕ General Information



The LDL Facility in Seattle





Street & Area Outdoor Lighting Center at South Seattle Community College





Street & Area Test Site at SSCC





Lighting Design Lab Team

Kurt Nielsen, LC, CLEP
Manager



Elizabeth Lyon
Marketing &
Communications



Andrew Pultorak, LC, MIES
Lighting Specialist



Eric Strandberg, LC
Sr. Lighting Specialist



Jeff Robbins, LC, MIES
Lighting Specialist



Andrea Dahlman
Mockup Technician





With Respect to SSL Initiatives

- ⊕ Lighting Design Lab provides support to Utilities, Energy Conservation Organizations and their customers
- ⊕ Fills voids in the market that could impair utility conservation programs
 - Lighting Education Programs
 - Projects & Deliverables
 - Add value by solving problems



Educational Series & Workshops



Lighting Industry Innovations and Trends for 2013

Instructor: Andrew Pultorak, LC, MIES

Morning Class: 10:00 a.m. - Noon

This class will review trends and the latest innovations in commercial and industrial lighting. We will also profile award winning products recognized by the industry for their advancements in energy efficiency.

This course is intended for those familiar with basic lighting terminology, e.g., CRI, CCT, L/W, LED, OLED, but also appropriate for those just entering the field.

Exterior Lighting - A New Look

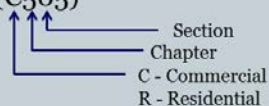
Instructor: Eric Strandberg, LC

Afternoon 1:00 p.m. - 3:00 p.m.

One of the bright spots with the LED revolution is exterior lighting. This intermediate level class will look at the overall landscape of exterior lighting by reviewing the new Illuminating Engineering Society (IES) recommendations and luminaire design opportunities. Included will be an examination of walkways, parking lots and building entries demonstrating how LED lighting can be applied primarily in existing and retrofit installations.

WA and Seattle Energy Code

- Commercial / Residential (C505)



DEFINITION: RESIDENTIAL BUILDING

...includes detached one- and two-family dwellings (townhouses) as well as R-2, R-3, and R-4 buildings three stories or less in height above grade plane.

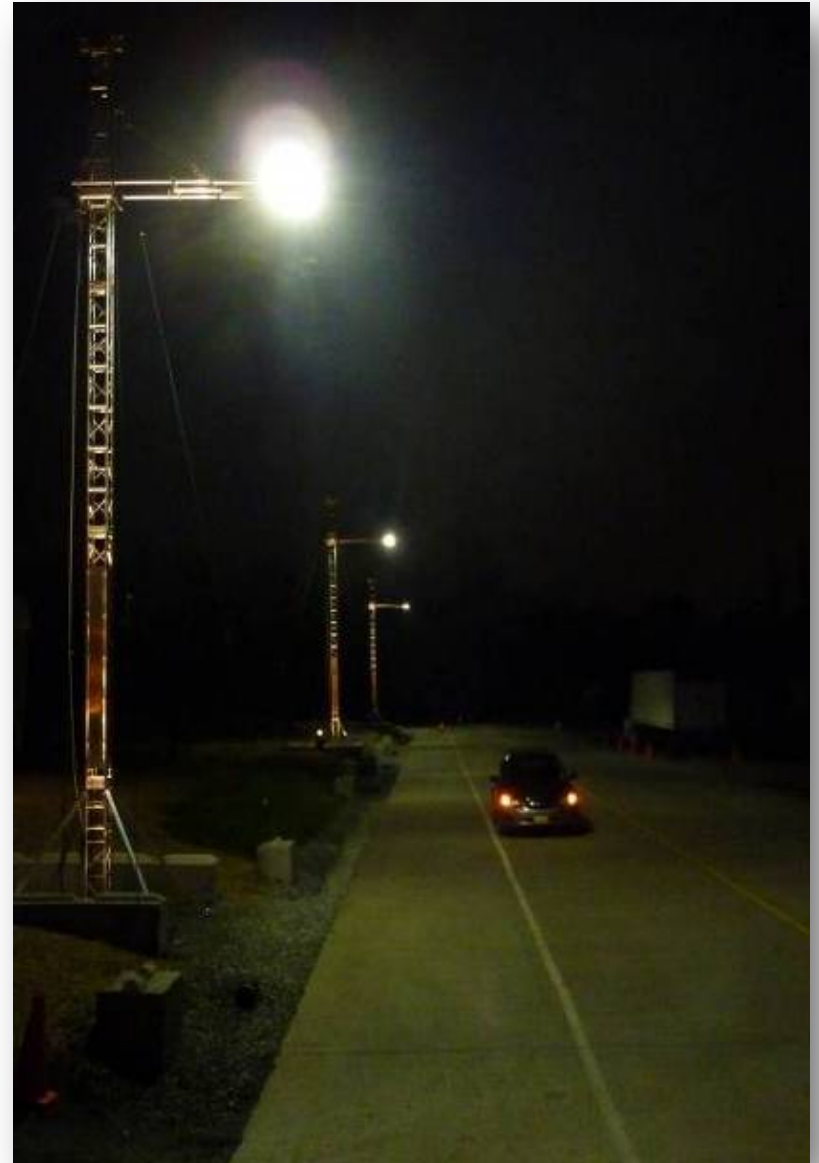
- R1 = single family
- R2 = single family and duplex
- R3 = single family thru duplex
- R4 = multi-family developments





LDL SSL Testing & Evaluation Projects

- ⊕ LED Field Studies conducted by Lighting Design Lab
- SDOT Street Lighting
 - PNNL LED T8 Replacement Lamp





LED A-Lamps Have *Arrived*





New demonstration / Field test

LED T8s – Are they getting closer?



Modified troffers function as work lights, a demonstration, and a “field test”.

Still require a variety of rewiring methods of fixtures and sockets.





LDL Qualified LED Products List



Problem

- Utilities needed a way to determine the relative quality of LED lighting products that were being specified for projects requesting rebate funding.
- Energy Star & DLC were taking too long to qualify products and were sometimes too narrow in scope for potential LED applications.



Solution

- Lighting Design Lab & Utility partners develop **LDL Qualified LED Products List**.
www.lightingdesignlab.com/led-list



A Northwest utility funded lighting education facility promoting commercial and industrial energy conservation.

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LED List Product Submission

Thank you for your interest in submitting product(s) for qualification to the Lighting Design Lab LED List.

This is an interim qualifying List used by Northwest utilities for rebate consideration while lighting products are being reviewed by ENERGY STAR or the DesignLights Consortium® (DLC).

There are several steps to complete in this process.

To ensure a smooth submission and to avoid any potential delays, there are some things to be aware of before beginning:

1. Download all three submission forms (below) & save them to your computer
2. Follow all 4-steps outlined on the [How to Qualify Your Product](#) page
3. Make sure to thoroughly complete all of the forms
4. Send submissions AND all follow-up inquiries to ledlist@lightingdesignlab.com

[LED List Specifications - DOWNLOAD](#)

[Manufacturers Checklist \(PDF\) - DOWNLOAD](#)

[Manufacturers Checklist \(Word\) - DOWNLOAD](#)

[How to Qualify Your Product](#)

Current LDL LED Qualifying Products List

[LDL Lamp List](#)

[LDL Fixture List](#)

[LDL Status List](#)



LDL Qualified LED Products List

This list is maintained by the Lighting Design Lab for Puget Sound Energy, Seattle City light, Snohomish PUD, Tacoma Power, the Energy Trust of Oregon, Bonneville Power Administration, Idaho Power, and the Eugene Water and Electric Board. **Note: This is an interim qualifying list while products are being reviewed by ENERGY STAR or DLC. Products will be permanently removed 12 months after "Post Date".**

If you don't see a product on this list, check the ENERGY STAR or DLC lists. All products carry a 5 year warranty. Contact ledlist@lightingdesignlab.com for more information.

Fixture/Lamp Type	Manufacturer	Model Number	Lamp Voltage	CCT	Input Wattage	Efficacy LPW	Rated Lumens	CRI	R9 Value	Post Date
Bollards	QSSI	BOFRLF1X12U65KSF	120	6500 K	14.7	56.1	822.4	72.9	-25.3	03/14/13
Cove Lights	LED Power	SB8-1/2W-48"-28K-24V	120	2800 K	20.5	47.4	970	85.5	32	11/14/12
		SB8-1/4W-72"-35K-24V	120	3500 K	10.4	49.8	519	83.8	24.3	12/10/12
		SB8-1/4W-66"-35K-24V	120	3500 K	10.4	49.8	519	83.8	24.28	12/10/12
		SB8-1/4W-60"-35K-24V	120	3500 K	10.4	49.8	519	83.8	24.28	12/10/12
		SB8-1/4W-48"-35K-24V	120	3500 K	10.4	49.8	519	83.8	24.28	12/10/12
		SB8-1/4W-46"-35K-24V	120	3500 K	10.4	49.8	519	83.8	24.28	12/10/12
		SB8-1/4W-36"-35K-24V	120	3500 K	10.4	49.8	519	83.8	24.28	12/10/12
		SB8-1/4W-24"-35K-24V	120	3500 K	10.4	49.8	519	83.8	24.28	12/10/12
		SB8-1/4W-12"-35K-24V	120	3500 K	10.4	49.8	519	83.8	24.28	12/10/12
		3LB-6D-M160-4100K-NP	120	4100 K	22.0	73.0	1606	84.0	25	03/21/13
		3LB-6D-(L/R)080-4100K-LP	120	4100 K	16.7	68.5	1151	84.0	24	03/21/13
		3LB-5D-M160-4100K-NP	120	4100 K	18.4	72.4	1343	84.0	24	03/21/13
Display/Refrigerated Case	1 Source	3LB-5D-(L/R)080-4100K-LP	120	4100 K	14.0	69.6	1151	83.0	23	03/21/13
		3LB-4S-M120-4100K-LP	120	4100 K	11.6	73.9	857	84.0	24	03/21/13
		3LB-4D-M120-4100K-HP	120	4100 K	21.8	70.6	1540	83.0	22	03/21/13
		3LB-4D- (L/R) 120-4100K-NP	120	4100 K	15.3	69.4	1062	83.0	22	03/21/13
		3LB-4C-M060-4100K-HP	120	4000 K	21.4	73.2	1567	84.0	26	03/21/13
		3LB-3C-M060-4100K-HP	120	4000 K	16.6	70.1	1164	83.0	23	03/21/13
	Efficient Lights	472-18C-024C-B1	120	3000 K	27.7	55.5	1525	81.5	12	11/27/12
		472-18C-024C-B2	120	3000 K	27.7	55.5	1525	81.5	12	11/27/12
		472-9C-024S-B1	120	3000 K	16.1	47.8	767	81.5	12.4	12/10/12
		472-9C-024S-B2	120	3000 K	16.1	47.8	767	81.5	12.4	12/10/12
		458-18C-024C-B1	120	3000 K	23.5	65.6	1540	80.7	5.8	05/17/13
		458-9C-024S-B1	120	3000 K	13.4	59.7	800	80.6	6.2	05/17/13
		353-13C-024C-B1	120	3000 K	21.4	52.5	1119	81.4	12.4	05/17/13
		353-7C-024S-B1	120	3000 K	12.9	47.4	613	81.6	12.6	05/17/13
		339-13C-024C-B1	120	3000 K	18.9	59.5	1124	80.8	5.9	05/17/13
		339-7C-024S-B1	120	3000 K	11.4	55.8	1124	80.4	5.6	05/17/13
		458-18C-024C-B2	120	3000 K	23.5	65.6	1540	80.7	5.8	05/17/13
		458-9C-024S-B2	120	3000 K	13.4	59.7	800	80.6	6.2	05/17/13
		353-13C-024C-B2	120	3000 K	21.4	52.5	1119	81.4	12.4	05/17/13
		353-7C-024S-B2	120	3000 K	12.9	47.4	613	81.6	12.6	05/17/13
		339-13C-024C-B2	120	3000 K	18.9	59.5	1124	80.8	5.9	05/17/13
		339-7C-024S-B2	120	3000 K	11.4	55.8	1124	80.4	5.6	05/17/13
	Feelux	DIVA2 7W	24	4000 K	7.2	61.0	525	82.3	20	05/10/13
		DIVA2 HO 12W	24	4000 K	11.2	81.3	870	83.8	22.7	05/10/13
		DIVA2 HO 24W	24	4000 K	22.3	81.0	1740	84.5	26.9	05/10/13
		GEDSH71-1	24	7100 K	6.4	110.0	720	76.4	0	09/13/13
	GE Lighting	GEMX71-1	12	7100 K	0.5	92.2	41	76.9	0	09/13/13
		GEMXH71-1	12	7100 K	0.7	102.0	54	77.4	0	09/13/13
		GEPM71-1	12	7100 K	1.6	84.0	130	75.6	0	09/13/13
		GESSH71-1	12	7100 K	4.0	86.5	360	76.6	0	09/13/13
		GEWHDSPS6	24	7100 K	6.3	75.9	534	76.0	0	09/13/13
		GEWHSSPS3	12	7100 K	3.2	77.4	267	76.2	0	09/13/13



Lighting Design Guides



Problem

- NEEA wanted materials for training contractors, ESCOs, and facility managers on how to properly evaluate energy-efficient lighting options for specific applications.



Solution

- Lighting Design Lab developed a series of Lighting Design Guides for commercial spaces that are frequently targeted for lighting retrofits and upgrades. www.lightingdesignlab.com/publications



Lighting Design Guides

LIGHTING LAYOUT GUIDE SERIES

GAS STATION GUIDE 1

ROOM CHARACTERISTICS

Length: 50'
Width: 54'
Height: 18' Hard Ceiling
Reflectivity:
Ceiling = 80%
Walls = n.a.
Floor = n.a.

PRODUCT SPECIFICATIONS



Courtesy: Beacon Lighting

Dimensions: 12" x 12"
Lens: Clear Acrylic
Lamps: (3) LEDs
Lumens per Fixture: 5924
Absolute, as opposed to
Relative Photometry*
Lamp Lumen Depreciation:
~0.95
Total Fixture Efficiency: ~70%
Watts: 87

*The standard method for testing
light output and distribution of
LED lighting fixtures.
Total lumen output of the
luminaire with lamp installed.

GAS STATION

LED RETROFIT



THE OPPORTUNITY

Retro-fit existing metal halide system with fixtures providing high quality lighting that illuminates the pump island area to recognized standards and meet or beat the local energy codes. Because energy codes and light level recommendations no longer meet newer lamps are rated at ~15, 60,000 hours or higher.

* L70 is the useful life or the luminaire output.

THE SOLUTION

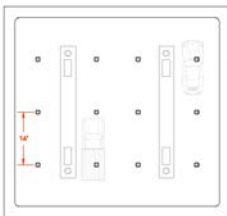
Install LED luminaires spaced with an existing spacing suggested spacing-to-m are also sealed and gain main advantages of using where the task is being areas.

DESIGN CONSIDERATIONS

Though vertical illuminance is on appropriate horizontal contrast ratio of 2.5-14, the driving lane pavement

LAYOUT OPTIONS

Gas Station LED Retrofit | 14' On Center Spacing, Centered Within Driving Lane



INSTALLATION SPECS

Number of Luminaires: 12
Luminaire Spacing: 14' on center, within driving lane
Mounting Condition: Surface
Mounting Height: 18'
Average Illuminance: ~12 fc
Watts/eq. ft.: ~0.38

IES Recommended Footcandles (fc):
10 - 15 fc

CONTROLS

Due to energy codes, occupancy sensors or building energy management systems MUST be used to turn lights off automatically when occupants are away or during after hours. Because gas stations are often open 24/7 in commercial districts in major metro areas, the most practical energy management device is a simple astronomical digital time clock, programmed to come on an hour before dusk, and go off an hour after dawn.

ADDITIONAL ENERGY SAVING STRATEGIES

STRATEGY	WATTS/LUMINAIRE	SAVINGS	LIGHT LEVELS
Lighting panel with astronomical time clock - dusk/dawn	~87w	40% to 50%	Equal to base design

*"Meta-Analysis of Energy Savings from Lighting Controls in Commercial Buildings", LBNL-S9956, September 2011.

ENERGY CODE INFORMATION

JURISDICTION	CODE	LIGHTING POWER ALLOWANCE (BUILDING EXTERIORS)
Seattle	2009 Seattle Energy Code	0.80 w/sq. ft. (Zones 3 + 4 Combined)
Washington	2009 WSEC	1.0 w/sq. ft. (Zone 4)
Oregon	2010 OEEEC	1.0 w/sq. ft. (Zone 4)
Idaho	2009 IECC	1.0 w/sq. ft. (Zone 4)
Montana	2009 IECC	1.0 w/sq. ft. (Zone 4)

LIGHTING LAYOUT GUIDE SERIES:

GAS STATION | LED RETROFIT

LIGHTING LAYOUT GUIDE SERIES

PARKING GARAGE GUIDE 1

ROOM CHARACTERISTICS

Length: 225'
Width: 116'
Height: 11' Hard Ceiling
Reflectivity:
Ceiling = 40%
Walls = 20%
Floor = 20%

PRODUCT SPECIFICATIONS



Courtesy: Kim Lighting

Dimensions: 18" diameter
Reflector: Acrylic
Lamps: (60) LED diodes
Lumens: Absolute, as opposed to
Relative Photometry*
Lamp Lumen Depreciation: 0.70
Total Fixture Efficiency: 83%
Watts: 72

*The standard method for testing
light output and distribution of
LED lighting fixtures.
Total lumen output of the
luminaire with lamp installed.

PARKING GARAGE

LED RETROFIT



THE OPPORTUNITY

Provide high quality lighting that illuminates both the horizontal driving surfaces and vertical stalls of the parking garage to recognized standards and meets or beats the local energy codes. Like all LED systems, this option has the advantage of coming to either 50% brightness or to full brightness more quickly than the HID systems they tend to replace.

THE SOLUTION

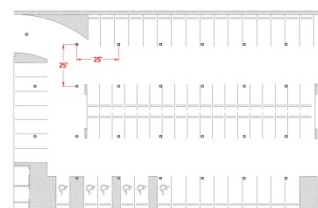
Install low-bay industrial garages. While this delivers similar illumination uses less wattage hours. This option added benefit of energy performs well in commercial

DESIGN CONSIDERATIONS

As in many similar horizontal and vertical level, energy management garage fixtures are through optical shield as a 2-lamp fluore

LAYOUT OPTIONS

Parking Garage LED Retrofit | 25' x 25' Spacing



INSTALLATION SPECS

Number of Luminaires: 34
Luminaire Spacing: 25' x 25'
Mounting Condition: Surface
Mounting Height: 10'5"
Average Illuminance:
~3.7 fc horizontal
~2.9 fc vertical
Watts/eq. ft.: ~0.10

IES Recommended
Footcandles (fc):
5 fc Average
1 fc Minimum
10:1 Max/Min Uniformity Ratio

CONTROLS

Lighting in parking garages must have one or more control devices to automatically reduce lighting power in any one controlled zone by at least 50% within 30 minutes of all occupants leaving that zone. One cost effective solution is specifying luminaires with integral occupancy sensors, many of which can be programmed for bi-level control. This will minimize wiring labor costs.

ADDITIONAL ENERGY SAVING STRATEGIES

STRATEGY	WATTS/LUMINAIRE	SAVINGS	LIGHT LEVELS
Daylight controls on perimeter to turn off fixtures	~72w	100% (daytime only)	Maintained from daylight

ENERGY CODE INFORMATION

JURISDICTION	CODE	LIGHTING POWER ALLOWANCE (PARKING GARAGES)
Seattle	2009 Seattle Energy Code	0.20 w/sq. ft.
Washington	2009 WSEC	0.20 w/sq. ft.
Oregon	2010 OEEEC	0.26 w/sq. ft.
Idaho	2009 IECC	0.30 w/sq. ft.
Montana	2009 IECC	0.30 w/sq. ft.

LIGHTING LAYOUT GUIDE SERIES:

PARKING GARAGE | LED RETROFIT



22+ Lighting Layout Guides

- › Retail Refrigerator Cases Guide
- › Retail Displays LED Retrofit
- › Warehouse - T8 HP Fluorescent
- › Warehouse - T5 HO Fluorescent
- › Private Office - T8 HP Fluorescent
- › Private Office - Fluorescent Lensed
- › Parking Garage - T8 Fluorescent
- › Parking Garage - LED Retrofit
- › Open Warehouse - T8 HP Fluorescent
- › Open Warehouse - T5 HO Fluorescent
- › Open Warehouse - Highbay Induction
- › Open Office - T8 HP Fluorescent Retrofit
- › Open Office - T8 HP Fluorescent - Lensed
- › Open Office - T8 HP Fluorescent D/I
- › Open Office - Fluorescent Acrylic Lensed
- › Gymnasium - T8 HP Fluorescent
- › Gymnasium - T5 HO Fluorescent.pdf
- › Gas Station - LED Retrofit
- › Cold Storage - LED Highbay
- › Classroom - T8 HP Fluorescent - Lensed
- › Classroom - T8 Fluorescent - D/I
- › Foot Candle Lighting Guide



Energy Trust of Oregon

⊕ Problem

- Lighting specifiers need to know the recommended light levels for the types of spaces that they are targeting for energy-efficient lighting projects. Not every lighting specifier has access to the IES Lighting Handbook 10th Edition (contains over 1,300 pages and costs \$595).

⊕ Solution

- Lighting Design Lab created **Quick Reference Light Level Guide** for commonly upgraded spaces.

IES Lighting Handbook 10th Edition

Applications | Lighting for Education

Applications | Lighting for Education





Table 24.2 | Educational Facilities Illuminance Recommendations continued from previous page

Recommended Maintained Illuminance Targets (lux) ^{b,c,d}																	Uniformity Targets ^e			Typical Area of Coverage ^h	
Applications and Tasks ^a	Notes	Horizontal (E _h) Targets					Vertical (E _v) Targets					Overall Area of Coverage			Task Proper or Task Area	Room or Designated Area					
		Visual Angles of Observers (years) where at least half are					Visual Angles of Observers (years) where at least half are					1 st ratio E _h /2 nd ratio E _v if different uniformities apply									
		<25	25-65	>65			<25	25-65	>65			Max:Avg	Avg:Min	Max:Min							
		Category				Gauge	Category				Gauge										
AUDITORIUM	(continued)																				
• Performance	Dedicated to artistic performances (likely fixed seating). For dedicated theaters see 28 LIGHTING FOR HOSPITALITY AND ENTERTAINMENT																				
• House	As the architect coordinates contrast markings with steps, curbs, and ramps, localized lighting may be deemed appropriate.																				
• During event			2	2	2	Min	F	5	10	20	Avg			5:1/3:1							
• Pre/Post event		L	37.5	75	150	Avg	K	25	50	100	Avg			3:1							
• Stage																					
• Access ramps/stairs	See AUDITORIUM/Circulation																				
• Amateur productions																					
• Dance (performance)	E _h @ floor; E _v @ 5' AFF	P	150	300	600	Avg	R	250	500	1000	Avg			1.5:1							
• Demonstration		T	500	1000	2000	Avg	R	250	500	1000	Avg			3:1							
• Music		P	150	300	600	Avg	R	250	500	1000	Avg			2:1							
• Theater	Simple, no stage lighting cues	P	150	300	600	Avg	P	150	300	600	Avg			2:1							
• Professional productions	Stage lighting as determined by production crew; See IES DG-20-09 Stage Lighting A Guide to the Planning of Theatres and Auditoriums for guidance on architectural and electrical infrastructure																				
• Prefunction	Anteroom or transition space adjoining auditorium																				
• During event		K	25	50	100	Avg	I	15	30	60	Avg			3:1							
• Pre/Post event, intermission		N	75	150	300	Avg	L	37.5	75	150	Avg			3:1							
• Sound and light lock	Transition from lobby or foyer space adjoining auditorium																				
• During event			2	2	2	Min	I	15	30	60	Avg			5:1/3:1							
• Pre/Post event, intermission		M	50	100	200	Avg	K	25	50	100	Avg			3:1							
BUILDING ENTRIES	See 22 LIGHTING FOR COMMON APPLICATIONS																				
CLASSROOMS																					
• Arts																					
• Art Studios		R	250	500	1000	Avg	P	150	300	600	Avg			3:1							
• Graphic Arts																					
• Displays																					
• Fine art	See 21 LIGHTING FOR ART																				
• Permanent/Temporary	Awards, student art, plaques																				
• Dimensional																					
• Dark finish	<50% reflectance		5 times background illuminance					5 times background illuminance					4:1								
• Light finish	≥50% reflectance		3 times background illuminance					3 times background illuminance					4:1								
• Flat																					
• Horizontal																					
• Dark finish	<50% reflectance		5 times background illuminance					5 times background illuminance					4:1								
• Light finish	≥50% reflectance		3 times background illuminance					3 times background illuminance					4:1								
• Vertical																					
• Dark finish	<50% reflectance		5 times background illuminance					5 times background illuminance					4:1								
• Light finish	≥50% reflectance		3 times background illuminance					3 times background illuminance					4:1								

Table 24.2 | Educational Facilities Illuminance Recommendations continued next page

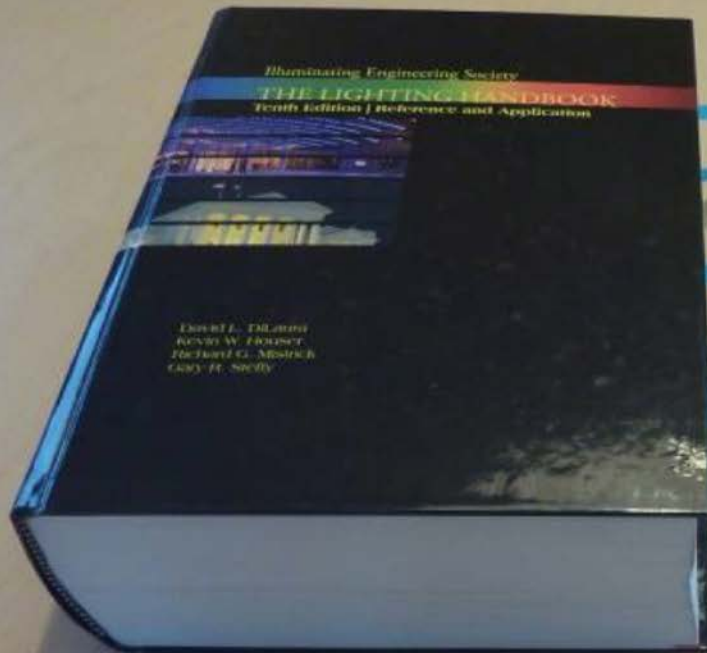
Notes for Table 24.2

The table column headings are discussed in detail in 24.3 Illuminance Criteria. See 12.5.5 Illuminance for discussion on procedures for establishing illuminance targets for a project.

- Applications, tasks, or viewing specifics encountered on any given project may be different from these and may warrant different criteria. See 24.2.1 Applications and Tasks. The designer is responsible for making final determinations of applications, tasks, and illuminance criteria.
- Values cited are to be maintained over time on the area of coverage.
- Values cited are consensus and deemed appropriate for respective functional activity. In a few situations, code requirements are within 10% of IES recommendations. This is apparently an artifact of metrication. Footcandle conversions of any values cited in Table 24.2 should be made at 1 fc to 10 lx. Regardless, codes and ordinances may supersede any of the IES criteria for any of the applications and tasks and the designer must design accordingly.
- Targets are intended to apply to the respective plane of the task.
- Illuminance uniformity targets offer best results when planned in conjunction with luminance ratios and surface reflectances. Any parenthetical uniformity values reference respective parenthetical applications or tasks, such as a curfew situation associated with nighttime outdoor lighting.
- Applications and tasks cited with sunburst icon  are candidates for strategies employing any combination of daylighting and electric lighting to achieve target values during daylight hours. Daylighting may require nontraditional approaches.
- Tasks with specular components, like computers with CSA/ISO Type III screens or printed tasks with glossy ink or glossy paper, are prone to veiling reflections. The likelihood of an application's or task's predisposition to veiling reflections is indicated by the reflected light icon: black and white  signals high likelihood; gray and white  signals moderate likelihood; pale gray and white  signals some likelihood; and all-white signals little-to-no likelihood.
- The designer must establish areas of coverage to which targets apply. Green highlight identifies task proper or task area as the typical area of coverage for respective cited targets. Amber highlight identifies room or designated area as the typical area of coverage for respective cited targets.
- Alternatively, design to specific tasks, if known, from READING AND WRITING.
- For applications where task position is indefinite, such as some types of flexible meeting rooms, the typical area of coverage is "Room or Designated Area." For applications where task position is known, such as an office desk or a reading chair, a more efficient approach is likely achieved when target illuminance is applied to the "Task Proper or Task Area."



Not Exactly Portable





Quick Reference Light Level Guide



FOOT CANDLE LIGHT Guide

FOOT CANDLE LIGHT GUIDE

Foot candles are the most common unit of measure used by lighting professionals to calculate light levels in businesses and outdoor spaces. A foot candle is defined as the illuminance on a one-square foot surface from a uniform source of light. The Illuminating Engineering Society, IES, has recommended the following foot candle levels to ensure adequate illumination and safety for occupants. Below is a guideline for common areas to assist in achieving appropriate light levels with the greatest energy efficiency.

Building Area & Task	Average Maintained Foot-Candles (Horizontal) (FC)	Range of Maintained Foot-Candles (Horizontal) (FC)	Average Maintained Foot-Candles (Vertical) (FC)	Range of Maintained Foot-Candles (Vertical) (FC)	Comments
WAREHOUSING & STORAGE					
Bulky Items—Large Labels	10		5		
Small Items—Small Labels	30		15		
Cold Storage	20	10 - 30	10	5 - 15	
Open Warehouse	20	10 - 30			
Warehouse w/Aisles	20	10 - 30	10	5 - 15	
COMMERCIAL OFFICE					
Open Office	40	30 - 50			@30" Above Finished Floor (AFF)
Private Office	40	30 - 50			@30" AFF
Conference Room	30				Matte surface reflectance for the table 40% recommended
Restroom	18	7.5 - 30			
Lunch & Break Room	15	5 - 20			
EDUCATIONAL (SCHOOLS)					
Classroom	40	30 - 50			@30" AFF
Gymnasium					
Class I (Pre or Div 1 College)	125		30		
Class II (Div 2 or 3 College)	80		20		
Class III (High School)	50		150		
Class IV (Elementary)	30		100		
Auditorium	7.5	3 - 10	5	2.5 - 10	
Corridor	25	10 - 40			

This guide is a collaborative effort of Energy Trust of Oregon and the Lighting Design Lab in Seattle, Washington.



Building Area & Task	Average Maintained Foot-Candles (Horizontal) (FC)	Range of Maintained Foot-Candles (Horizontal) (FC)	Average Maintained Foot-Candles (Vertical) (FC)	Range of Maintained Foot-Candles (Vertical) (FC)	Comments
INDUSTRIAL/MANUFACTURING					
Assembly					
Simple (Large Item)	30	15 - 60	30	15 - 60	
Difficult (fine)	100	50 - 200	100	50 - 200	
Component Manufacturing					
Large	30	15 - 60	30	15 - 60	
Medium	50	25 - 100	50	25 - 100	
EXTERIOR					
Parking (Covered)	5				IFC min, 10:1 Max to Min Uniformity
Parking (Open) (Medium Activity)					
Lighting Zone 3 (Urban)	1.5	.75 - 3	.8	.4 - 1.6	
Lighting Zone 2 (Suburban)	1	0.5 - 2	.6	.3 - 1.2	
Gas Station Canopy	12.5	10 - 15			
Safety (Building Exterior)	1	0.5 - 2			If security is an issue—raise average level to 3
RETAIL					
General Retail (Ambient)		50			
Department Store	40	20 - 80	15	7.5 - 30	
Perimeter			75	35 - 150	
Accent Lighting (Displays)					3 - 10 times greater than ambient light levels
AUTOMOTIVE					
Showroom	50	25 - 100	10	5 - 20	
Service Area	50	25 - 100	30	15 - 30	
Sales Lot (Exterior)					
Lighting Zone 3 (Urban)	20	10 - 40	20	10 - 40	
Lighting Zone 2 (Suburban)	15	7.5 - 30	15	7.5 - 30	
GROCERY					
Circulation	20	10 - 40	7.5	3.5 - 15	
General Retail	50	25 - 100	20	10 - 40	
Perimeter			50	25 - 100	
BANKING					
ATM	20	10 - 40	15		Vertical at face of ATM

NOTES:

- This guide is based on information gathered from the IES "The Lighting Handbook" 10th Edition.
- It is highly recommended that all lighting professionals refer to the full IES guide when specifying lighting projects.
- At least half of users are in the 25 - 65 age range.
- Horizontal—horizontal plane that average maintained foot-candles are measured
- Vertical—vertical plane the average maintained foot-candles are measured
- It is the responsibility of the specifier to determine and provide appropriate lighting levels for each space

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Moving Forward

Future Initiatives

- ⊕ **Expansion of the LDL Qualified LED Products List**
 - Automated product submission process
 - Searchable and filterable dynamic list
 - Update & revise product specifications (e.g., Duv tolerance on exterior LED fixtures)
 - Eliminate Cinderella clause (12 month expiration) on qualified products that fall outside the scope of Energy Star & DLC

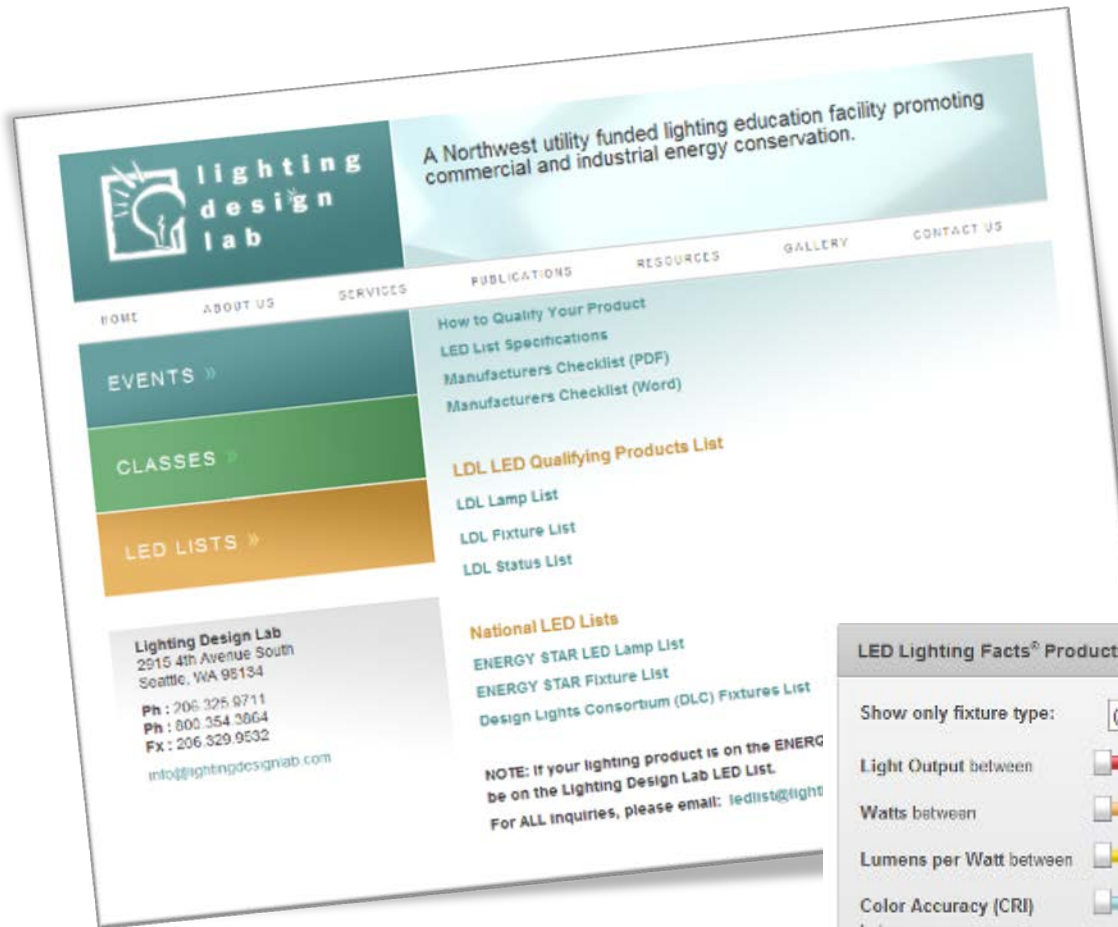
- ⊕ **Advocate & support the establishment of baseline standard for energy efficient lighting professionals**
 - Poorly designed & executed lighting projects hurt us all!



LDL LED List- Improved functionality

Coming soon...

- Working with Lighting Facts
- Real-time time pre-screening
- Interactive searchable list



**lighting
facts**
LED Product Partner

LED Lighting Facts® Products Search Tool

Show only fixture type: (All Fixture Types)

Light Output between 0 and 82000 lm

Watts between 0 and 900 W

Lumens per Watt between 0 and 200 lm/W

Color Accuracy (CRI) between 0 and 100 (CRI)

Light Color (CCT) between 0 and 10300 K

9076

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